THE INNOVATION CATALYST

May 2022

IN THIS ISSUE:

DID YOU KNOW?...

with SBIR/STTR Center Lead Joseph Famiglietti:

The SBIR/STTR Program is a valuable tool that can enable instrument development, demonstration of new measurement capabilities, and even hardware for flight missions.

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UPCOMING EVENTS:

INNOVATOR HOUR

TUESDAY, MAY 10, 2022

1:00–2:00 P.M.

STRATEGIC PARTNERSHIPS OFFICE

NP-2022-4-763-GSFC

HAPPY AUTONOMOUS VEHICLE DAY!

Since 2017, May 31 has been designated as National Autonomous Vehicle Day. The primary agenda is "to appreciate the growth of science and the development of technology that will provide us with a safe and sound environment into the future."

The Institute of Electrical and Electronics Engineers (IEEE) has estimated that up to 75 percent of cars may be autonomous by 2040. While the adoption of self-driving cars depends on many factors, the enabling technologies are already here thanks in good part to NASA. The same laser-based technologies developed by NASA engineers to allow for safe landings on the Moon and Mars are being applied to help weave through rush hour traffic on this planet.

Today's landers use multiple technologies, including next-generation sensors, cameras, specialized algorithms and high-performance computers, all working together. A key component is lidar, a detection system based on light waves instead of radio waves for detecting objects and calculating their distance. NASA-developed lidar systems are finding use in space and here on Earth.

In 2016, the Virginia-based company Psionic licensed a version of lidar called navigation Doppler lidar (NDL) from NASA's Langley Research Center in Hampton, Virginia. NDL detects the movement and velocity of distant objects and a spacecraft's (or an autonomous vehicle's) own motion. Last year, NASA and Psionic signed a licensing agreement for a lidar technology called Kodiak, which Goddard engineers developed for generating a 3D image for data collectors to measure the altitude and position of a target's surface. In 2018, NASA's Satellite Servicing Projects Division officially baselined the Kodiak system for real-time images and distance-ranging information for a NASA project called Restore-L, demonstrating autonomous satellite-servicing capabilities.

Here on Earth, Psionic founder Steve Sandford, formerly of NASA, has said that the company's customers in the automotive industry are using the lidar technologies for navigation and collision avoidance in self-driving systems for cars. Without NASA's efforts over many years, he says that such advances on this planet would not have been possible.

FEATURED SPINOFFS

LINE OF BABY SWADDLES

LITTLE LOTUS

In the 1980s, NASA researched ways they could maintain heat inside a spacesuit. NASA was able to leverage phase-change materials (PCMs), which steadily absorb heat and transfers it quickly to humans. The material is nontoxic and nonflammable.

In 1987, NASA's Johnson Space Center awarded a Small Business Innovation Research (SBIR) contract to the Florida-based Triangle Research and Development Corporation to experiment in using PCMs to steadily absorb heat. Jane Chen, co-founder and former CEO of Embrace Innovations who launched a line of consumer products called Little Lotus, was then able to find this technology and used it to help create Little Lotus's line of baby swaddles that help keep infants nice and warm.

POLYMER COMPOSITES

IMITEC

Robert Bryant, an engineer at NASA's Langley Research Center created polymer composites that were used to withstand the stresses of supersonic air travel. These polymers were then used by Imitec Inc.

The Schenectady, New York-based company, which focuses its efforts on polyimide and polymers that can tolerate high temperatures without deforming, was able to utilize the knowledge gained from NASA's SBIR program to develop a new, more durable polymer material that's being tested in specialized hip replacement implants.

WATER BOTTLES

CAMELBAK

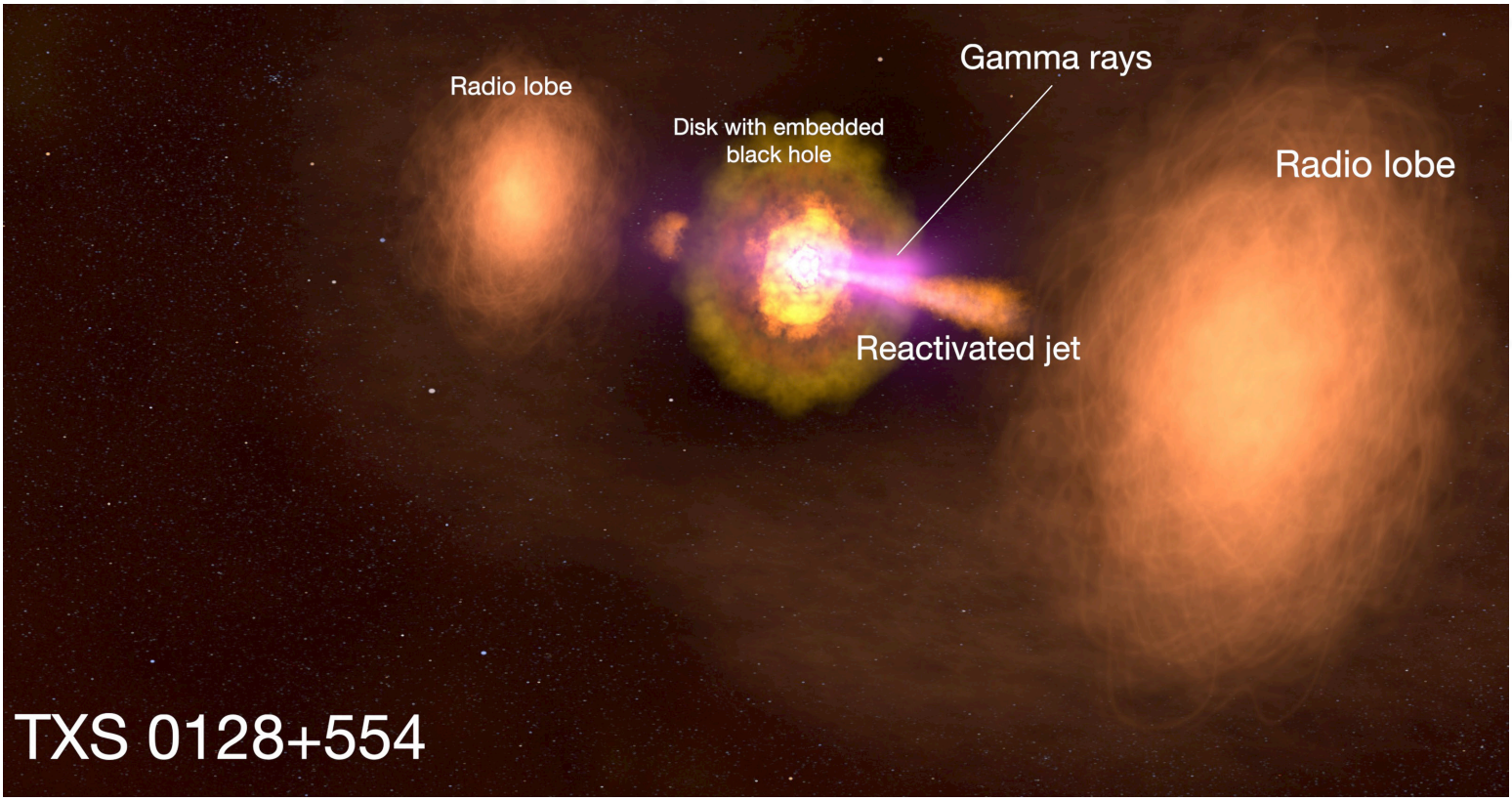
Originally used to keep rockets cool, NASA's Kennedy Space Center developed the first aerogel composite in the 1990s. Innovators then realized the technology could be viable for numerous commercial uses. Under a NASA SBIR contract, Peraluma, California-based CamelBak used this technology to insulate their company's line of water bottles, which helps to keep the water inside them cool.

MAY THE FOURTH BE WITH YOU

When NASA Technology Meets Pop Culture

Ideas about space and the technologies that make space exploration possible have deep roots in popular culture. Many of Goddard's employee innovators have no doubt gotten some of their inspiration from Star Wars and other representations of space exploration they grew up seeing in popular science fiction films. Perhaps some of you took some time out on May 4th—Star Wars Day—to revisit one or more of these iconic movies.

Another way to celebrate Star Wars Day, belatedly, is to revisit some of the parallels between NASA technologies, the missions and visualizations they've enabled, and the Star Wars universe. Perhaps these musings also will inspire you to think creatively about what's to come from the next-generation technologies and ideas you're developing now and those you'll see into the future.



Remind you of anything? A few years ago, NASA's Fermi Gamma-ray Space Telescope reported TXS 0128+554 (TXS 0128 for short) as a faint source of gamma rays. After taking a closer look using the Very Long Baseline Array (VLBA) and NASA's Chandra X-ray Observatory, they found that TXS 0128 is 500 million light-years away in the constellation Cassiopeia. It is an active galaxy anchored by a supermassive black hole around one billion times the mass of the Sun.

Researchers added the galaxy to a long-running survey conducted by the VLBA, a network of radio antennas operated by the National Radio Astronomy Observatory stretching from Hawaii to the U.S. Virgin Islands. The array's measurements provide a detailed map of TXS 0128 at different radio frequencies. The radio structure they revealed spans 35 light-years across and tilts about 50 degrees out of our line of sight. This angle means the jets aren't pointed directly at us and may explain why the galaxy is so dim in gamma rays. For fans of Star Wars, it was hard not to notice that the young active galaxy resembles Darth Vader's TIE fighter spacecraft in "Star Wars: Episode IV - A New Hope."

The connections between NASA technology and TIE fighters go deeper than this, however. "TIE" stands for "Twin Ion Engines". Years of NASA research and development led to the first real ion engines. They have the potential to propel spacecraft at incredible speeds, using very little fuel in the process as is needed for deep space missions to Mars and beyond. Of course, NASA has also produced real-life "droids" and many more technologies with parallels to the Star Wars universe.

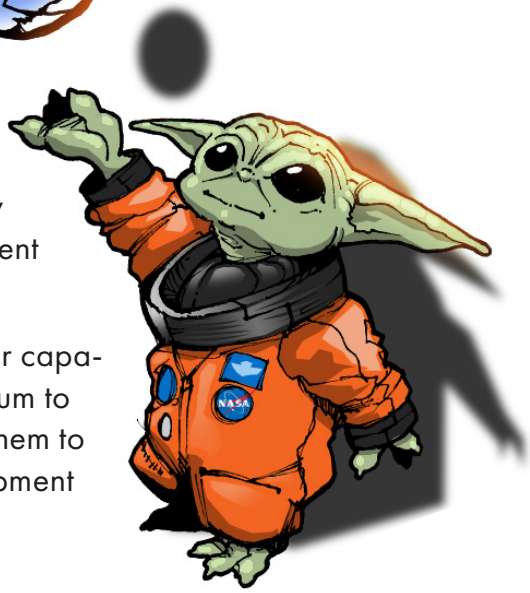
You Have Crossed Over into...The Twilight Zone

If you missed celebrating Star Wars, you'll have another chance to revel in popular culture on National Twilight Zone Day this May 11. It is a good day to look back and celebrate the science in science fiction and the unexpected twists that sometimes lead to future innovations. It turns out that several episodes of the famed TV series from the 1950s and 1960s featured ideas about space, from a convict living alone on an asteroid to families traveling through space to another planet to escape from war here on Earth.

The twilight zone is the realm or mental state between reality and fantasy. In the ocean, "twilight zone" has another meaning. It is the greatest depth at which light can penetrate. Goddard has a science task group dedicated to the development of investigations and innovations to support high-priority science for exploring ocean worlds.

Last year, NASA deployed the oceanographic field campaign called Export Processes in the Ocean from Remote Sensing (EXPORTS). A primary aim of the NASA-led campaign and partnership with the National Science Foundation is to explore the role of the ocean in the global carbon cycle. They want to learn how carbon moves through the ocean, especially in the twilight zone, in part because this area has not been well studied previously.

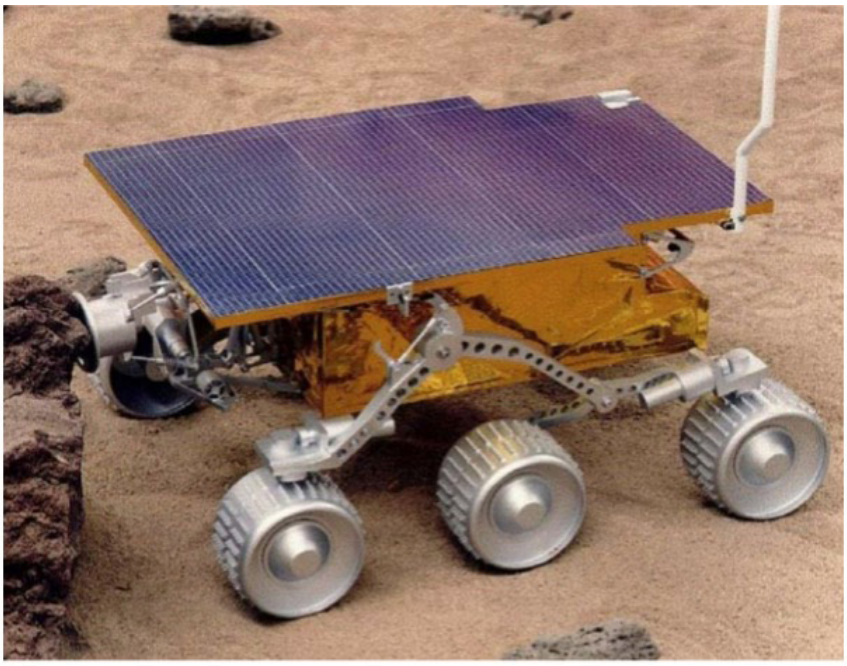
EXPORTS will have implications beyond the ocean sciences for improving satellite technologies. Goddard's Ivona Cetinić, a project scientist on the EXPORTS team, works with optical measurements that come from ocean color satellites, which measure visible light reflected from the ocean surface. These measurements can reveal features including temperature, salinity, carbon, and concentrations of a green pigment called chlorophyll. Phytoplankton vary in the amounts and shades of green chlorophyll they produce, creating slight but important variations in ocean color that current ocean satellites cannot yet capture.



Cetinić has said that satellites of the future will need to have even greater capa- collecting data across the visible spectrum and outside the visible spectrum to up on these subtleties. What they are observing now on Earth will help them to derstand what they hope to one day see from space, fueling the development of next-generation Earth-observing satellites.

NASA's Contributions to the Small Business Community

According to the U.S. Small Business Administration (SBA)'s, Office of Advocacy, small businesses are the lifeblood of the U.S. economy. Small businesses create two-thirds of the net new jobs and drive U.S. innovation and competitiveness. A January 30, 2019 report from the Office of Advocacy reflects that small businesses account for 44% of U.S. economic activity. Additionally, a 2020 study by the SBA shows there are 31.7 million small businesses in the United States. This accounts for more than 90% of all U.S. businesses.



The U.S. government, including NASA, relies on the small business community to foster creative and innovative thinking to help the agency achieve its mission and support its operations and programs. For example, it was Yardney Technical Products, a small business with 150 employees out of Stonington, Connecticut, who produced the battery that powered the NASA Sojourner Mars Pathfinder rover in 1997. The battery enabled NASA to reach a tremendous milestone.

To celebrate small businesses, the month of May is dedicated to recognizing the value of the small business community. National Small Business Week typically occurs in the first week of May. That's seven days where we nationally recognize one of the most important pieces of our economy! So, in May, the Strategic Partnerships Office (SPO) joins the rest of the nation in recognizing and applauding the courage, community efforts, and hard work of our entrepreneurs.

Our own NASA Goddard Space Flight Center (GSFC or "Goddard") plays an important role in supporting and cultivating small businesses. For years, Goddard has seen many businesses that successfully transitioned from small business status to become a large business. Companies such as Stinger Ghaffarian Technologies, Inc. (SGT) and QSS Group, Inc. are two examples of companies that had their origins at Goddard. In addition to Goddard's Small

Business Office, the Strategic Partnerships Office provides opportunities to small businesses. In fact, SPO receives support services from a small business, N4 Solutions, LLC, for our small business programs and initiatives such as Technology Transfer ("T2"), Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR), and Partnerships. Although these programs do not solely target small businesses, some truly are designed for the small business community.

NASA **TECHNOLOGY TRANSFER** PROGRAM

Among the many challenges the small business community faces is access to capital to bring thought leadership and innovations to fruition. Most small businesses do not have a research and development (R&D) or Independent Research and Development (IRAD) budget. But SPO can potentially help. We offer programs that can help small businesses overcome obstacles to obtaining capital to support incremental growth or company expansion. Rather than seeking funds for R&D efforts, which often requires substantial access to capital, small businesses can license previously developed, deployed, and proven technologies, inventions, and software from NASA to help accelerate company growth. Through the SPO T2 program, small businesses can review the NASA Patent Portfolio and/or the NASA Software Catalog to identify candidate technologies and inventions for licensing to help drive incremental revenue, gain access to new markets, and/or carve out a competitive position for small businesses. For new startup businesses, NASA offers non-exclusive licenses of NASA patented technologies, which do not include **any up-front costs**.

SBIR · STTR
America's Seed Fund™
POWERED BY SBA

In addition to the T2 program, SPO offers small businesses the opportunity to participate in the SBIR/STTR Program. As Goddard and NASA identify topics relating to research, development, or proof of concepts that fulfill the Center or Agency's needs through Requests for Information (RFIs) or solicitations, small businesses with 500 employees or less, can obtain funding through SBIR/STTR grants. Small businesses can receive SBIR/STTR funding up to $1 million in the first three years with no concern for financial underwriting or interest payments.

NASA PARTNERSHIPS
REACHING OUR MISSION GOALS TOGETHER

Finally, SPO makes available to the small business community opportunities to enter a strategic relationship with NASA through the Partnership program. A partnership with NASA increases small business capabilities, presents opportunities for revenue growth, enhances organizational credibility, and provides for brand recognition. Consistent with the Space Act, NASA seeks and encourages maximum participation from the small business community in its programs through the implementation of Space Act Agreements. Through the partnership, small businesses gain access to unique resources such as expertise, facilities, equipment, and/or technologies.

THE STRATEGIC PARTNERSHIPS OFFICE PRESENTS

INNOVATOR HOUR

Do you have questions about protecting your innovation?

Do you want to learn more about how to submit New Technology Reports?

Do you have general questions about technology transfer or partnerships?

SPO can help!

Sign up for a 20-minute Innovator Hour timeslot and get a one-on-one Teams session with a SPO representative!

NEXT SESSION: **TUESDAY, MAY 10, 1:00-2:00 P.M.**

HOW DO I SIGN UP?

To register for the upcoming session and secure your timeslot, please fill out this form.

Timeslots available:

1:00-1:20 P.M.

1:20-1:40 P.M.

1:40-2:00 P.M.

NATIONAL INVENTORS MONTH

If it was not for the creativity and innovation of inventors,we would still be reading by candlelight, traveling by horseback or writing with a quill pen. In celebration of human ingenuity, every May since 1998 is observed as National Inventors Month.

In honor of this special occasion, NASA Goddard Space Flight Center's Technology Transfer Office would like to introduce you to some of the prolific engineers and scientists at Goddard who have been inducted into the National Inventors Hall of Fame.

Frank "Cepi" Cepollina

Known as the "Father of On-Orbit Servicing," Cepollina's exceptional innovation and leadership has generated many of the groundbreaking concepts, designs and procedures that have kept the Hubble Space Telescope at the cutting edge of technology throughout its long lifespan. Always an innovator, he established the architecture for NASA's first serviceable Multi-Mission Modular Spacecraft, which indelibly improved the way that space missions are conceptualized and executed.

Cepollina's work has led to important medical, manufacturing, and educational spinoffs. These include a Hubble Space Telescope instrument Charge Coupled Device (CCD) now used for breast cancer detection, an

intelligent, programmable, hand-held power tool developed for servicing Hubble that is now finding manufacturing applications, and highly sophisticated, precision Hubble-type optics being employed to produce smaller, denser, and faster computer chips.

Among his many accolades, in 1985 he received a NASA Exceptional Achievement Award for leading the Solar Maximum Repair Mission.

Emmitt Chappelle

Honored as one of the top 100 African American scientists and engineers of the 20th century, Chappelle's innovative research with NASA focused in the area of bio-luminescence. A recipient of NASA's Exceptional Scientific Achievement Medal and 14 U.S. patents, Chappelle's work as a research chemist supported many of NASA's manned space flight initiatives. As part of the Viking program, his research helped NASA scientists develop a way to remove soil from Mars.

Using chemicals from fireflies as well as adenosine triphosphate (ATP), Chappelle developed a method of detecting life as well as microbiological organisms on other planets. He also used this extensive research in bioluminescence to detect bacteria in water. Ever the innovator, he later developed techniques that are still widely used for the detection of bacteria in urine, blood, spinal fluids, drinking water, and foods.

Still, some of Chapelle's most interesting work remains in the area of luminescence, where his research showed how satellites can measure luminescence levels to monitor the health of crops, including growth rates, water conditions, and harvest timing to enhance food production.

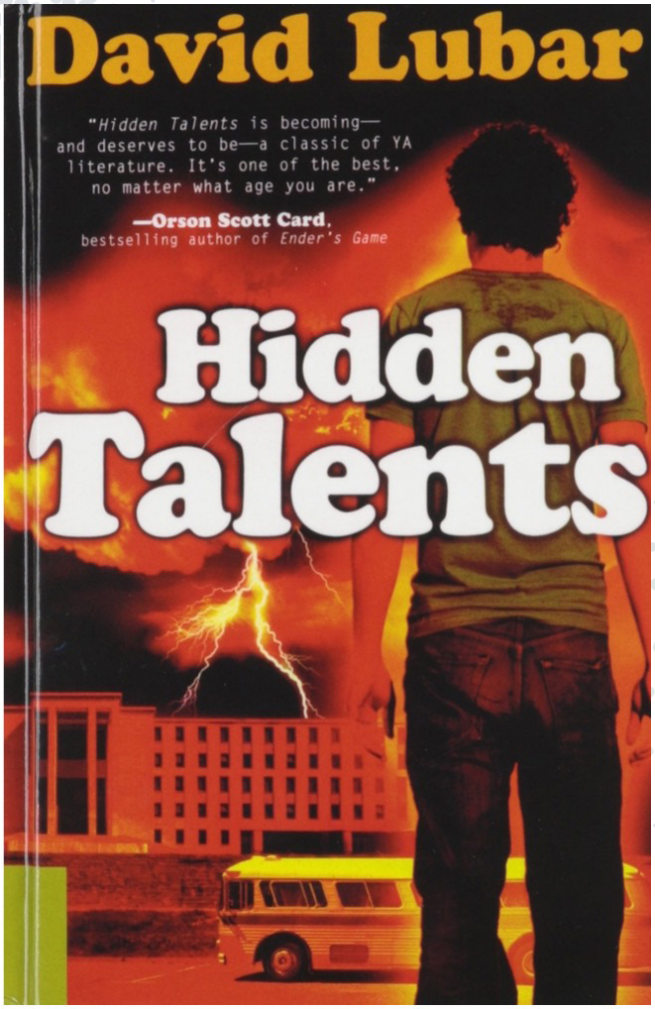
George E. Alcorn Jr.

A pioneering physicist and engineer, Alcorn led a four-person NASA team that developed the first X-ray imaging spectrometer using aluminum thermomigration. The result was a smaller, more sensitive device that set the stage for significant changes in deep space exploration methods. X-ray spectrometry, which received a patent in 1984, was used by NASA to obtain information about remote solar systems and other space objects.

Over his career with NASA and private industry, Alcorn designed more than 30 noteworthy inventions and received eight patents. For example, he is regarded as a pioneer in the field of plasma semiconductor devices. Mr. Alcorn's concept and implementation of "plasma etching" has become a standard in the industry. The Institute of Electrical and Electronic Engineers honored him with a historical recognition for his contribution to the fabrication of semiconductor devices by plasma as part of the institute's Global History Network.

In 2010, Alcorn received the Robert H. Goddard Award for Merit, for his outstanding innovation and significant contributions to space science, technology, and NASA programs.

THE LITERARY X-CHANGE BOOK OF THE MONTH



Hidden Talents, the first novel in a hit supernatural duology for young readers by award-winning author David Lubar, is a hilarious coming-of-age story starring the misfits at Edgeview Alternative School. Now available in trade paperback, the book was shortlisted for the Michael L. Printz Award, which annually "recognizes" the book that best exemplifies literary excellence in young adult literature."

When thirteen-year-old Martin Anderson arrives at the Edgeview Alternative School, it's the end of the road. Literally. He's been expelled from every other school. Edgeview is the last stop. A warehouse for the system's rejects.

Martin fits right in.

Everyone has given up on Martin. Even Martin. But at Edgeview Martin falls in with a group of five outsiders who make the other Edgeview rejects appear gifted by comparison. He makes a remarkable discovery: each of his friends possesses a remarkable talent. One is telekinetic. Another is empathic. Others have psychic abilities. Martin thinks these talents make them special. They think it makes them freaks.

Martin has one shot to convince them otherwise.

(Publisher's Summary)

WHAT IS THE LITERARY X-CHANGE?

In 2021, the Strategic Partnerships Office (SPO) launched a community library—with a little help from Tor Books. Goddard has partnered for years with Tor, a leading publisher of science fiction, by connecting them with subject matter experts to promote the science in "science fiction." Located in the lobby of Building 22, The Literary X-Change is available to the entire Goddard community. Here's how it works:

TAKE ONE

If a book strikes your fancy take it. Read it, enjoy it, and—when you're done—share it with a friend or bring it back to the X-Change.

GIVE ONE

Everyone can pitch in to keep the library stocked. Bring books you'd like to share with the Goddard community when you can and continue being a friend of The Literary X-Change!